

July 26, 2001

MEMORANDUM FOR: Clifton S. Middleton  
Project Director, Survey Section B

FROM: Charles W. Challstrom  
Director, National Geodetic Survey

SUBJECT: INSTRUCTIONS: NEW YORK FBN, 2001 (GPS-1596)  
Task Number: 8K6D2000

GENERAL:

The National Geodetic Survey (NGS) and New York State Department of Transportation (NYSDOT) are spearheading a campaign to observe stations of the Federal Base Network (FBN) and Cooperative Base Network (CBN) to complete the ellipsoidal and orthometric height components of the FBN and CBN as established by the NGS Strategic Plan. This survey will observe the 25 FBN stations and approximately 91 CBN stations in New York and tie to the FBNS and CBNs in the surrounding states. Stations in the provinces of Quebec and Ontario, Canada, will also be co-observed by three different Canadian agencies.

All the FBN stations have been recovered and are suitable for GPS occupation.

Network stations ARP (PID LX1523) and T 444 (PID NA1829) have been added to the project in order to check ellipsoid heights versus leveling.

Station JOHN BROWNS GRAVE RM 1 (PID PG0931) has been added to the project, as both a network station and a gravity station.

Also, four stations have been added to serve as bench mark ties. They are: G 406 (PID OE0481), G 460 (PID NA1974), K 236 (PID PH1115), and Q 464 (PID NB1654).

Also, four stations in Nassau County have been added in order to tie in a Nassau County GPS project. The stations are BRIDGE (PID KU2902), SALISBURY (PID KU3133), DONAHUE (PID KU3199), and 18E04R (PID KU5129).

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Finally, a bench mark at each of 13 tide gauge sites is also included in the project. Three sites are along Long Island Sound. They are: Kings Point, The Battery, and Montauk Point. Ten sites are along the Great Lakes and are: Ogdensburg, Alexandria Bay, Cape Vincent, Oswego, Rochester, Olcott, Buffalo, Sturgeon Point, Niagara Intake, and Waddington.

A full-wavelength, dual-frequency Global Positioning System (GPS) receiver is needed to act as Central Temporary CORS (CTCORS) throughout the project. The receiver shall be deployed at relatively secure stations within the vicinity of the ongoing observing sessions. The receiver shall continuously collect data at a 30-second epoch collection interval for a minimum of 72 hours and for as long as observations are ongoing in the vicinity of the CTCORS.

The project will be performed under the technical management of NGS.

#### PURPOSE:

In order to meet America's accelerating positioning and navigation needs, the existing coordinate reference system must be continually enhanced to provide the accessibility and high accuracy required for use with GPS. The digital revolution in mapping, charting, and surveying requires a National Spatial Reference System (NSRS) consisting of, among other components, a network of monumented points having four-dimensional positions. The FBN fulfills the requirements for this component. NGS is charged with the Federal responsibility for establishment, observation, monitoring, and maintenance of the FBN. The FBN provides the critical network foundation for an accurate, consistent, reliable NSRS.

The NSRS, in turn, provides the common geographic framework for America's spatial data infrastructure. As such, the NSRS serves as the basis for mapping, charting, navigation, boundary determination, property delineation, infrastructure development, resource evaluation surveys, and scientific applications, including crustal motion monitoring, modeling of flooding, storm surge, pollution trajectories, and agricultural runoff. A modernized, accurate, consistent, reliable NSRS is of enormous benefit to state, county, tribal, local, and Federal authorities, as well as to the private sector.

The 13 tide site surveys will provide GPS-derived ellipsoid heights, accurate to 2 cm, on water level and tide marks along the Great Lakes and Atlantic Ocean coast.

#### SPECIFICATIONS:

Project requirements for the FBN and CBN observations are to ensure 2-centimeter local accuracy in the horizontal component, as well as 2-centimeter local accuracy for the ellipsoid heights.

Data from the CORS in the region are to be used in the processing. There are 12 National CORS in the area to be selected from. Five are in New York, three are in Pennsylvania, and one each is in Massachusetts, Vermont, Rhode Island, and New Jersey. There are also two Cooperative CORS (one in New York and one in Rhode Island) and a base station (Atrium) in the province of Quebec, Canada, to use as well. Also, there are two CORS in Canada (Algonquin and Ottawa) that are part of the Canadian Active Control System (CACS) and can be used.

Finally, there are several base stations in New York to obtain data from. (There is also one in Connecticut.) The base stations in New York are located in Amherst, Orchard Park, Elma, and Syracuse.

Others in New York that might possibly be available are in the Albany area, Ithaca, Jamestown, and Binghamton. The (community) base station in Connecticut is located in Newington.

The five National CORS in New York are: Paul Smith's College (PSC1), Hudson Falls (HDF1), Syracuse (SYCN), Youngstown (YOU1), and East Moriches (MOR1) (on Long Island). The three National CORS in Pennsylvania are: Wilkes Barre (WIL1), Titusville (UPTC), and Penn State (PSU1). Westford (WES2) (an IGS station) is the National CORS in Massachusetts; and Montpelier (VCAP), Newport (NPRI), and Newark (NJI2) are the National CORS in Vermont, Rhode Island, and New Jersey, respectively.

The Cooperative CORS in New York (NYEC) is located in Delmar and is run by the Wildlife Resources Center of the New York Environmental Conservation. The Cooperative CORS in Rhode Island (URIL) is located in Kingston and is run by the University of Rhode Island. The community base station in Connecticut is located in Newington.

Positions for and data from the National CORS are available from the NGS web site. Data for the two Cooperative CORS and the two CACS CORS in Canada can also be accessed via the NGS web site. To obtain data from the Quebec base station (Atrium), contact Mr. Yves Theriault, Ministere des Ressources naturelles (listed under LIAISON).

To find out if any of those base stations that might possibly be available are, indeed, available, contact Jeff Olsen, NGS4 (listed under LIAISON). The contact to obtain data from the Orchard Park and Elma base stations is Mr. Neil Watson, TVGA Engineering & Surveying (listed under LIAISON). The contact for the Amherst base station is Mr. Chris Schregel, Town of Amherst Engineering Department (listed under LIAISON). Mr. James Beeler, Maine Technical Source, (listed under LIAISON), is the contact for the Syracuse base station. To obtain data from the Newington, Connecticut, community base station, contact Mr. Bob Baron, Connecticut Department of Transportation.

General specifications for the project are as follows. At each FBN and CBN site, three sessions of 5 1/2 hours duration each shall be observed. The observing scheme shall be arranged so that for each station, the start time of one of the observing sessions shall be at least 4 hours different from the other two.

Each FBN station must be occupied at least three times - twice at one observing window and once at the other. The observing scheme shall be arranged to ensure that adjacent FBN and adjacent CBN stations are directly connected in at least one observing session, and at least half of all base lines are repeated. The CORS base lines will be repeated. CORS and CTCORS data will be used throughout the project.

Each FBN, if not a first- or second-order bench mark, must be tied to two different bench marks. This bench mark tie requirement can be satisfied in one or two sessions.

For this project, each CBN station must also be occupied three times as described above. However, CBN stations can be tied to adjacent FBN stations if the FBN station is closer than an adjacent CBN station. The repeated-base line requirement also applies to the CBN, although a base line consisting of a CBN station and a FBN station (instead of two CBN stations) can also be used. The two bench mark tie requirement also applies to the CBN.

In general, station occupation and observing procedures must be carried out according to appropriate sections of the "NGS Operations Handbook" and the current applicable receiver field manuals. Data formats and digital file definitions are given in "Input Formats and Specifications of the National Geodetic Survey Data Base," Volume I. Horizontal Control Data, Federal Geodetic Control Subcommittee, September 1994, revised and reprinted November 1998. Success in meeting the accuracy standards will be based on repeatability of measurements and adjustment residuals.

General specifications for the project are given in "Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques," Version 5.0: dated May 11, 1988, reprinted with corrections August 1, 1989. Specific project criteria and deviations from the general specifications are given in the following sections.

Project Network - A list (Table 1) and sketch of stations involved in this project will be provided.

Data Acquisition - Data collection must be accomplished as specified in the appropriate dual-frequency receiver field manuals in the compressed mode at a 15-second epoch collection interval. The GPS receivers must be dual-frequency and full-wavelength. Track satellites down to a 10-degree elevation angle.

The satellite observing scenario has been determined. Sessions will generally begin at two observing windows at least 4 hours apart - 1200 UTC and 1630 UTC. Vectors between the project stations shall be measured by single sessions consisting of continuously and simultaneously tracking for 5 1/2 hours.

Record weather data just before, immediately after, and at the mid-point of each session. Meteorological data shall also be collected immediately after an obvious weather front passes during a session and immediately before it passes, if possible. Pressure and relative humidity measurements must be made near and at about the height of the GPS antenna phase center. Indicate in the log the location of the barometer and psychrometer.

Survey operations shall be conducted with due regard to the safety of personnel and equipment. Contact with the airport traffic control tower is mandatory during surveys at any controlled airports.

Vector Computations - Data management, quality review of collected data, and final vector processing for the FBN/CBN survey will be accomplished using PAGES. Vectors shall be computed in the International Earth Rotation Service Terrestrial Reference Frame (ITRF) system, using the most current epoch and precise IGS ephemerides. Use 30-second epoch intervals for data processing. Monument positions will be used for CORS when available, otherwise, antenna reference point (ARP) positions will be used. Mr. Jeff Olsen, N/NGS4, will be responsible for the processing.

The data will be processed in 24-hour sessions (or slightly longer if the observation session crosses 0000 UTC) in order to utilize the 24-hour data sets collected at the CORS and CTCORS. The "fixed baseline" option in PAGES will be used to compute direct baselines between the CORS and CTCORS. The "fixed baseline" scheme will depend on the location and reliability of the CORS and CTCORS used in this project.

For stations where weather data are not available, or are suspect, predicted values will be computed and used based on the station's latitude, height above mean sea level, and time and day of year. Use 15 degrees as the cutoff elevation angle in data processing. A cutoff angle of 10 degrees may be used when necessary to improve results.

The type of final solution, L1 versus ion-free, will depend on the length of the vectors. For vectors which are less than 10 km in length, the final reduction will consist of a L1 fixed solution. These vectors will be computed in a separate processing session from the longer vectors computed in an ion-free solution.

In general, vectors greater than 10 km in length are to be computed in an ion-free fixed, or partially-fixed, solution. In all cases, integer ambiguities will be fixed for each vector whenever possible.

The quality of collected data shall be determined from the plots generated from PAGES, by analysis of repeated vectors and/or comparison of station positions, and free adjustment residuals and/or loop misclosures. In addition, a constrained adjustment constraining all CORS will be performed.

Jeff Olsen will perform all quality checks for conformance with NGS format standards such as executing software programs COMPGB, OBSCHK, and OBSDES. The final ITRF vectors will be assessed and transformed to the NAD 83 coordinate system using program ADJUST.

The data and results will be submitted to the Observation and Analysis Division. All B-files and G-files must be complete, including \*25\* and \*27\* records.

Station Descriptions - Station recovery notes must be submitted in computer-readable form using WDDPROC software. Include the name, address, and, if public ownership, the telephone number of the responsible party. Do not include the telephone numbers of private property owners.

Special Requirements - Antenna set-up is critical to the success of this project. Fixed-height tripods are preferred for all receivers. The plumbing bubbles on the antenna pole of the fixed-height tripod must be shaded when plumbing is performed. They must be shaded for 3 minutes before checking and/or re-plumbing. Also, the perpendicularity of the poles must be checked at the beginning of the project and any other time there is suspicion of a problem.

When a fixed-height tripod is not used, the height of the antenna must be carefully measured to prevent station set-up blunders from occurring. Tribrachs used for these set-ups must be checked and adjusted when necessary. Totally independent measurements of the antenna height above the mark in both metric and English units must be made before and after each session. Someone other than the observer must check the measurement computations by carefully comparing measurements and then entering his/her initials on the log.

Some GPS antennas have detachable ground planes and radomes. In order to help identify what exactly was used at a particular site, it would be useful to have a snapshot of the setup. All co-observers should take a photograph of the setup, if possible, with a close-up of the antenna as viewed from the side.

In addition, digital photographs of each survey mark are required.

See "Requirements for Digital Photographs of Survey Marks & CORS Antennas," Version 5, for specific information.

Also, a rubbing of the stamping of the mark must be made at each visit to a station. If it is impossible to make a rubbing of the mark, a plan sketch of the mark must be substituted, accurately recording all markings.

Also, for each station visited, a visibility obstruction diagram must be prepared and the TO-REACH description carefully checked for errors or omissions.

Lastly, the following must be recorded at each occupation of a station:

- (1) receiver manufacturer,
- (2) antenna manufacturer,
- (3) receiver model number (part number),
- (4) antenna model number (part number),
- (5) the complete serial number of the receiver, and
- (6) the complete serial number of the antenna.

Success of this project requires that the highest quality GPS data be collected. Therefore, during each station occupation, the operators shall carefully monitor the operation of the receivers. Any irregularities in the data due to equipment malfunction, DOD adjustment of the satellite orbit, obstructions, etc., must be reported to the Field Operations Branch, N/NGS41, as soon as possible and noted on the observing log. If the quality of observations for an observing session is questionable, notify the Field Operations Branch immediately.

The survey team shall not depart the project area until they have quality reviewed all data, advised N/NGS21, and notified N/NGS41.



GPS DATA:

Visibility tables and plots of the present satellite constellation for July 16, 2001, have been reviewed and two observing windows selected. For operational use, current data must be generated with Trimble mission planning software or from program SATMAP.

A project report and data listed in Annex L of "Input Formats and Specifications of the NGS Data Base" and in the attached addendum for the adjustment portion of the project must be transmitted. Any data considered suspect as to quality in achieving accuracy standards should be sent via FedEx immediately for office review. Backup of transmitted data must be held until notified by the Field Operations Branch, N/NGS41.

The data set collected during the project shall be named "nyro071d.874". All records in connection with this project shall be titled "NEW YORK FBN, 2001". The project number (accession number) is GPS-1596.

LIAISON:

Liaison must be maintained with designated offices at the National Geodetic Survey headquarters located at:

1315 East-West Highway  
Silver Spring, Maryland 20910-3282

Questions and problems concerning survey field operations should be directed to:

William T. McLemore, Jr.  
Chief, Field Operations Branch  
Observation and Analysis Division  
N/NGS41, SSMC III, Station 8564  
Telephone: 301-713-3215, ext. 117  
Fax: 301-713-4327  
e-Mail: Bill.Mclemore@noaa.gov

Questions and problems concerning adjustment processing should be directed to:

Maralyn L. Vorhauer  
Observation and Analysis Division  
N/NGS4, SSMC III, Station 8562  
Telephone: 301-713-3176, ext. 104  
Fax: 301-713-4327  
e-Mail: Maralyn.Vorhauer@noaa.gov

Questions and problems concerning vector processing should be directed to:

Juliana Blackwell  
Field Operations Branch  
Observation and Analysis Division  
N/NGS41, SSMC III, Station 8458  
Telephone: 301-713-3215, ext. 108  
Fax: 301-713-4327  
e-Mail: Juliana.Blackwell@noaa.gov

Questions and problems concerning using CORS data in processing should be directed to:

Neil Weston  
Geosciences Research Division  
N/NGS6, SSMC III, Station 9830  
Telephone: 301-713-2847, ext. 202  
Fax: 301-713-4475  
e-Mail: Neil.D.Weston@noaa.gov

Questions and problems which could affect the technical adequacy of the project should be directed to:

Stephen J. Frakes (Douglas R. Hendrickson)  
Project Development Branch  
Spatial Reference System Division  
N/NGS21, SSMC III, Station 8853  
Telephone: 301-713-3194, ext. 111 (ext. 127)  
Fax: 301-713-4316  
e-Mail: Steve.Frakes@noaa.gov  
(Doug.Hendrickson@noaa.gov)

The NGS project coordinator is:

Jeff Olsen  
Observation and Analysis Division  
N/NGS4, SSMC III, Station 8504  
Telephone: 301-713-3215, ext. 120  
e-Mail: jolsen@ngs.noaa.gov

The contact with the NYSDOT is:

Mr. David Hess  
New York State Department of Transportation  
Design Services Bureau  
Building 4, Room 214B  
1220 Washington Avenue  
Albany, New York 12232-0432  
Telephone: 518-485-1723  
e-Mail: dhess@gw.dot.state.ny.us

The contact for the Quebec, Canada, co-observing is:

Mr. Bernard Perron  
Service de la geodesie  
Ministere des Ressources naturelles  
5700, 4e Avenue Ouest, bureau E-305  
Charlesbourg (Quebec) Canada G1H 6R1  
Telephone: 418-627-6281, ext. 2010

The contacts for eastern Ontario, Canada, co-observing are:

Mr. Douglas Scott and Mr. Gordon Garrard  
Geodetic Survey Division  
NRCanada  
432 - 615 Booth Street  
Ottawa, Ontario, Canada K1A 0E9  
e-Mail: [DScott@NRCan.gc.ca](mailto:DScott@NRCan.gc.ca), [GGarrard@NRCan.gc.ca](mailto:GGarrard@NRCan.gc.ca)

The contact for western Ontario, Canada, co-observing is:

Mr. Ron Berg  
Deputy Chief Surveyor  
Geomatics Office  
Ministry of Transportation Ontario  
301 St. Paul Street  
St. Catharines, Ontario, Canada L2R 7R4  
e-Mail: [berg@mto.gov.on.ca](mailto:berg@mto.gov.on.ca)

The contact for the co-observing in Massachusetts is the NGS Geodetic State Advisor:

Mr. Curt Crow  
Massachusetts Highway Department  
Ten Park Plaza, Room 7410  
Boston, Massachusetts 02116  
Telephone: 617-973-8466  
e-Mail: [clcrow@aol.com](mailto:clcrow@aol.com)

The contact for Rhode Island co-observing is:

Ms. Kathy Cheteyan  
Rhode Island Department of Transportation  
Survey Section  
2 Capitol Hill  
Providence, Rhode Island 02903  
Telephone: 401-222-2815, ext. 4350  
e-Mail: [VCHETEYA@DOT.STATE.RI.US](mailto:VCHETEYA@DOT.STATE.RI.US)

The contact for the co-observing in Vermont is:

Mr. Dan Martin  
Vermont Agency of Transportation  
National Life Building, Drawer 33  
Montpelier, Vermont 05633  
Telephone: 802-828-2813  
e-Mail: [dan.martin@state.vt.us](mailto:dan.martin@state.vt.us)

The contact for Connecticut co-observing and the Newington, Connecticut, community base station is:

Mr. Bob Baron  
Connecticut Department of Transportation  
Unit 501, Room 4118  
2800 Berlin Turnpike  
Newington, Connecticut 06111  
Telephone: 860-594-2510

The contact for the Pennsylvania co-observing is:

Mr. Chuck Harpster  
Pennsylvania Department of Transportation  
Building 28  
Harrisburg International Airport  
Middletown, Pennsylvania 17057  
Telephone: 717-783-1519, ext. 3002

The contact for New Jersey co-observing is the NGS Geodetic State Advisor:

Mr. Warren Payton  
New Jersey Department of Transportation  
Geodetic Survey Section  
Box 600  
1035 Parkway Avenue  
Trenton, New Jersey 08625  
Telephone: 609-530-5654  
e-Mail: Warren.Payton@noaa.gov

The contact for the Orchard Park and Elma base stations is:

Mr. Neil Watson  
TVGA Engineering & Surveying  
1000 Maple Road  
Elma, New York 14059  
Telephone: 716-655-8842  
e-Mail: NWatson@tvga.com

The contact for the Amherst base station is:

Mr. Chris Schregel  
Town of Amherst Engineering Department  
1100 N. Forest Road  
Williamsville, New York 22221  
e-Mail: CSchregel@amherst.ny.us

The contact for the Syracuse base station is:

Mr. James Beeler  
Maine Technical Source  
2634 James Street  
Syracuse, New York 13206  
e-Mail: jbeeler@twcnny.rr.com

The contact for the Quebec, Canada, base station Atrium is:

Mr. Yves Theriault, M.Sc.  
Service de la geodesie  
Ministere des Ressources naturelles  
5700, 4e Avenue Ouest, bureau E-305  
Charlesbourg (Quebec) Canada G1H 6R1  
Telephone: 418-627-6281, ext. 2009  
(The web site address is: <http://www.mrn.gouv.qc.ca>)

For Long Island Sound tide site information, contact:

Mr. Bruce Servary  
Center for Operational Oceanographic  
Products and Services  
Requirements and Development Division  
N/OPS1, SSMC IV, Station 6425  
1305 East-West Highway  
Silver Spring, Maryland 20910  
Telephone: 301-713-2897, ext. 183  
Fax: 301-713-4435  
e-Mail: [Bruce.Servary@noaa.gov](mailto:Bruce.Servary@noaa.gov)

For Great Lakes water level site information, contact:

Mr. Brooks Widder  
Center for Operational Oceanographic  
Products and Services  
Requirements and Development Division  
N/OPS1, SSMC IV, Station 6540  
1305 East-West Highway  
Silver Spring, Maryland 20910  
Telephone: 301-713-2897, ext. 184  
e-Mail: [Brooks.Widder@noaa.gov](mailto:Brooks.Widder@noaa.gov)

Names and telephone numbers of local contacts are given in the station description material.

ADDRESS:

Keep N/NGS41 informed of the party's post office, physical address, and telephone number at all times.

PUBLICITY:

See "NGS Operations Handbook," Section 1.4.1.

EXPENSES:

FBN expenses for this project will be charged to task number 8K6D2000.

TRAVEL:

Travel and per diem are authorized in accordance with Federal Travel Regulations, Part 301-11, Per Diem Allowances. Current per diem rates were effective October 1, 2000.

ACKNOWLEDGMENT:

Please acknowledge receipt of these instructions in your Monthly Report.

cc: N/NGS - D. Zilkoski\*  
 N/NGS - S. Misenheimer\*  
 N/NGS1 - G. Mitchell  
 N/NGS1x1 - C. Crow  
 N/NGS1x1 - W. Payton  
 N/NGS11 - S. Cofer  
 N/NGS21 - S. Frakes  
 N/NGS21 - R. Anderson  
 N/NGS21 - D. Hendrickson\*  
 N/NGS22 - T. Soler  
 N/NGS3 - J. Bailey  
 N/NGS4 - J. Olsen  
 N/NGS4 - E. Wade  
 N/NGS4 - M. Vorhauer  
 N/NGS4 - D. Hoar  
 N/NGS41 - W. McLemore  
 N/NGS41 - J. Blackwell  
 N/NGS5 - R. Snay  
 N/NGS6 - N. Weston  
 N/OPS1 - B. Servary  
 N/OPS1 - B. Widder  
 FGCS Members\*  
 David Hess, New York State Department of Transportation  
 Neil Watson, TVGA Engineering & Surveying  
 Bob Prescott, Monroe County Department of Transportation  
 Kathy Cheteyan, Rhode Island Department of Transportation  
 Dan Martin, Vermont Agency of Transportation  
 Bob Baron, Connecticut Department of Transportation  
 Chuck Harpster, Pennsylvania Department of Transportation  
 Bernard Perron, Ministere des Ressources naturelles  
 Yves Theriault, Ministere des Ressources naturelles  
 Douglas Scott, NRCanada  
 Gordon Garrard, NRCanada  
 Ron Berg, Ministry of Transportation Ontario  
 Mike Hemmer, Brookhaven National Laboratory  
 Peter Lazio, Sidney Bowne Associates  
 Rob McCaffrey, Rensselaer Polytechnic Institute  
 Loren Gibson, SUNY - Alfred, NY  
 Peter Welsby, Wendel Duchsherer  
 Jonathan Cobb, Waypoint Technology Group  
 Gordon Sheret, Broome Community College  
 Larry Fabbroni, City of Ithaca  
 Chris Schregel, Town of Amherst Engineering Department  
 James Beeler, Maine Technical Source

\* first page only



**DATA TO BE SENT TO HEADQUARTERS RELATING TO  
THE ADJUSTMENT PORTION OF  
FBN/CBN PROJECTS**

Free adjustment in NAD 83 (UNIX run).

Plots of the free adjustment created by running "plotres\_prompt.bsh" on a UNIX server. Plots require a printer that supports postscript. The output file (long.out) contains a list of residuals which may be sorted using the following commands:

```
vi long.out
:1,$ !sort +0.47 (sorts horizontal residuals)
:1,$ !sort +0.71 (sorts vertical residuals)
```

(OPTIONAL) Constrained horizontal adjustment holding NGS CORS positions and ellipsoid heights.

Final combined Blue Book file (ASCII required) with \*86\* records (GEOID99).

Final description file (ASCII required.)

Final G-file (ASCII required.)

OBSCHK output.\* \*\*

CHKDDESC output.\*

OBSDES output.\*

\* Any errors or warning messages must be explained.  
\*\* Errors relating to incomplete \*86\* records are acceptable.